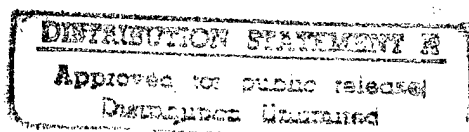




# CTN Report 93-017



## Text Case Development and Verification Guide for MIL-D-28000



**19 March 1993**

**19960822 213**

Prepared for  
Electronic Systems Center

**DTIC QUALITY INSPECTED 3**

CTN Report 93-017  
19 March 1993

---

**TEST CASE DEVELOPMENT  
AND  
VERIFICATION GUIDE  
FOR:  
MIL-D-28000**

**19 MARCH 1993**

---

**Prepared By**

NAVY CALS Test Bed  
Carderock Division  
Naval Surface Warfare Center  
Carderock, MD 20084-5000

**NSWC Contact**

Bernard Burns  
(301) 394-4310

Ben Kassel

(301) 227-1355

**DTIC QUALITY INSPECTED 8**

## Contents

1. Scope . . . . .	1
2. Overview . . . . .	1
3. Resources . . . . .	3
4. Test Case Specification . . . . .	6
5. System Selection and Preparation . . . . .	8
6. CAD Data Base Creation and Evaluation . . . . .	8
7. IGES File Creation . . . . .	10
8. Generation of Data Base Description . . . . .	12
9. Generation of Evaluation Script . . . . .	13
10. Storage and Delivery of Test Cases . . . . .	14
APPENDIX A: REFERENCES . . . . .	16
APPENDIX B: GLOSSARY . . . . .	17
APPENDIX C: TEST CASE FORMAT . . . . .	19

## 1. Scope

- 1.1. This document provides guidelines for developing and validating test cases for the evaluation of computer-aided design (CAD) systems compliance to reference [1], MIL-D-28000, Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols and user-defined requirements<sup>1</sup>. These references define the requirements to be met for product definition data exchange in the format specified in the Initial Graphics Exchange Specification (IGES), reference [2] or [3].
- 1.2. The user of this guide, hereafter referred to as "customer," is any DoD activity requesting the evaluation of CAD systems specifying compliance to a particular class in MIL-D-28000 and to the user-defined requirements. The customer selects the class in MIL-D-28000 to be tested. The decision whether reference [2] or [3] shall be used depends upon the class selected. Some classes specify reference [2] while others specify reference [3]. Reference [4] can be applied whenever reference [3] is specified since IGES is upwardly compatible.

## 2. Overview

- 2.1. The test cases created and validated according to this guide should be able to be applied to the test plan documented in reference [5]. This two-phased test plan presents the procedures for testing IGES processors compliance to MIL-D-28000 and user-defined requirements. The class is chosen by the customer, without any intentional guidance from this document nor from reference [5]. Phase I focuses on basic concepts pertaining to a selected class in MIL-D-28000. The purpose of Phase I is to determine whether the CAD system meets the minimal functional requirements and warrants further testing of typical application scenarios found in production. Phase II addresses production-oriented application scenarios. These scenarios stress particular aspects of the application which are likely to be encountered in production. Such scenarios are to be within the scope of

---

<sup>1</sup>User-defined requirements are additions or deviations from the standard necessary to fulfill the requirements of the digital data exchange program for a specific project.

the application as defined by the selected class in MIL-D-28000. This phase may be implemented if the results from the first phase of testing show compliance potentiality of the IGES processors, as determined by reference [5]. Such an approach insures that CAD systems are thoroughly tested to a wide range of applications common within the military.

2.2. A test case consists of the following items:

2.2.1. Purpose

This identifies the test case for selection by potential users. It indicates the test criteria, i.e. the selected class, the user-defined requirements and Phase I concepts or Phase II application scenario, of the test case. The Purpose also specifies the versions of this document and MIL-D-28000 used to construct the test case. Any deviations taken from the test criteria should be specified here.

The Purpose shall convey a Name, Version and Date. The Name is a unique identifier which will be assigned by the CTN. The test case developer is encouraged to suggest the Name. The Version is a two-character identifier. The first version of the test case shall be identified by an A and future versions subsequent letters through Z, AA, AB to ZZ. The Date is the date when the test case was accepted or last revised by the CALS Test Network (CTN).

2.2.2. Data Base Description

This describes the entities and relationships to be created in the CAD data base.

2.2.3. IGES File

2.2.4. Evaluation Script

This is the abstract script to which the CAD data base will be evaluated.

2.2.5. Plots

These are auxiliary graphics which will assist in the creation of the CAD data base and the assessment of the translation.

Appendix C presents suggested example formats of the Purpose, Data Base Description, and Evaluation Script. An example of a Phase I test case may be found in the CTN

"PYRAMID" Test Packet and a Phase II example in the "SPINDL" Test Packet.

- 2.3. Though these guidelines address generating test cases to any selected class in MIL-D-28000, it can also be applied to multiple classes. The similarities of selected, multiple classes with the user-defined requirements define the scope of criteria applied in test case development. Only the "lowest common denominator" between the selected classes should be acknowledged and applied. Any conflicts between requirements should be addressed.
- 2.4. The concepts or application scenario to be emphasized in a test case should have been chosen by the customer representatives, according to reference [5], prior to test case development.
- 2.5. All output generated during a stage of test case development should be reviewed at the conclusion of that stage. When the test case has been completed and approved, it will be provided to the CTN, as discussed in Section 10.

### 3. Resources

The following resources are needed for test case development to proceed:

- CAD System Administrator
  - appointed by the customer representatives, with the following qualification:
    - experience managing the hardware platform and the operating system environments of the CAD system and the IGES file analyzers;
  - shall perform the following duties:
    - manage and evaluate the installation of the CAD system to be tested with its required hardware platform;
    - install the automated IGES file analyzers with appropriate hardware specified by the testing administrator;
- Customer Representatives
  - appointed by the customer, with the following qualifications:
    - management of CAD projects for the customer;
    - experience as a CAD manager or user;
    - thorough understanding of this document, MIL-D-28000, and the user-defined requirements;

- knowledge of the customer's requirements;
- shall perform the following duties:
  - appoint test case developers;
  - specify required information for the Purpose, as defined in Section 2.2;
  - provide to the test case developers the graphical representations of the data base to be created;
  - select and provide the CAD system, including associated software and hardware, from which the CAD data base and IGES file will be generated;
  - provide the automated IGES file analyzers, specified by the IGES experts, and the appropriate hardware to support them;
  - select the CAD system administrator;
  - review the CAD data base, which will serve as source data for IGES file generation, to ensure that it accurately and comprehensively reflects the concepts or applications under test;
  - resolve data base discrepancies with the test case developers;
- Application Expert
  - appointed by the customer representatives, with the following qualification:
    - experience in the relevant application area;
  - shall perform the following tasks:
    - review the CAD data base, for IGES file generation, to evaluate its compliance;
    - resolve data base discrepancies with the test case developers;
- IGES Experts
  - appointed by the customer representatives, with the following qualifications:
    - experience with testing or performing analysis on a variety of CAD/IGES processors or developing CAD/IGES processors;
    - thorough understanding of this document, MIL-D-28000, the user-defined requirements, and reference [2] or [3];
    - working knowledge of the CAD system, used to create the test case, to be able to create, modify, and query the data base;
    - thorough understanding of IGES and the ability to correctly identify sections and entities in an IGES file without any supporting documentation;
  - shall perform the following duties:
    - specify the IGES file analyzer software to assist the evaluation of IGES files;

- manually review the IGES file for the test case for compliance to IGES, the selected class in MIL-D-28000, and the user-defined requirements and also against the CAD data base;
- examine the IGES file for the test case for compliancy to the selected class of MIL-D-28000 by the use of IGES file analyzer software;
- review Data Base Description for the test case by execution on heterogeneous CAD systems;
- resolve IGES file or Data Base Description discrepancies with the test case developers;
- Test Case Developers
  - appointed by the customer representatives, with the following qualifications:
    - thorough understanding of IGES and the ability to correctly identify sections and entities in an IGES file without any supporting documentation;
    - thorough understanding of MIL-D-28000, especially Sections 1.0 (Scope), 2.0 (Applicable Documents), 3.1 (General Requirements), 4.0 (Quality Assurance Provisions), 6.0 (Notes), and the section pertaining to the selected class;
    - thorough understanding of reference [5] and the user-defined requirements;
    - experience with the CAD system, from which the CAD data base and IGES file will be generated, to be able to create a CAD data base according to the selected application without any difficulties due to skill;
  - shall perform the following duties:
    - create and review the entire test case, including all preparatory research and development, except the Purpose;
    - resolve data base discrepancies with the customer representatives or the application expert;
    - resolve IGES file or Data Base Description discrepancies with the IGES experts;
  - CAD system, from which the CAD data base and IGES file will be generated, including IGES processors, all hardware required to support testing, and all software and hardware user documentation, specified by the customer representatives as specified in the role definitions in this section. Software documentation should specify CAD/IGES entity mapping scheme, CAD operator commands, and the CAD entities that these commands create or modify;



- IGES file analyzer tools and appropriate hardware, provided by the customer representatives<sup>2</sup>;
- discrepancy log to record all events as specified:
  - discoveries of the test criteria aspects which cannot be represented in the CAD data base, due to CAD entities which cannot be reflected as IGES entities compliant to the selected class in MIL-D-28000 and the user-defined requirements according to vendor documentation;
  - discoveries of functional aspects of the test criteria which cannot be represented in the CAD data base by any CAD entities;
  - discoveries of non-compliances to IGES, the selected class in MIL-D-28000, or the user-defined requirements, in the IGES file;
  - discoveries of inconsistencies of the IGES file compared to its source CAD data base;
  - discoveries of errors or limitations of the Data Base Description.

An individual can fill more than one roll in test case development.

#### 4. Test Case Specification

4.1. The application criteria of a test case, according to phase, is as follows:

Phase I: The concepts, selected by the customer representatives, should be commonly found in production of the selected application by the customers. Each emphasized concept in the test case should be stressed in the test case up to and including its limits as designated by the selected class in MIL-D-28000 and the user-defined requirements. The test case should reflect the minimum requirements for the selected application. The only information to be included which should supersede this minimum should stress the concepts under test.

Phase II: The application scenario is selected by the

---

<sup>2</sup>A list of such tools may be obtained on CERCNet, a public bulletin board system sponsored by West Virginia University

customer representatives based on customer requirements. The scenario should fulfill all requirements of the selected application according to the selected class of MIL-D-28000 and the user-defined requirements.

- 4.2. The customer representatives should generate the Purpose for the test case developers. The test criteria should be explicitly noted in a section entitled "Criteria" in the Purpose. The "Criteria" specifies the selected class with which the test case intentionally complies, user-defined requirements, and the concepts or application scenario under test. For example, concepts for a Phase I test case addressing Class II, engineering drawings, may include the following:

- dimensions;
- various drawing sizes;
- sectioned views, including use of different materials to demonstrate various crosshatching patterns;
- parts list;
- text notes;
- color;
- line weight;
- line font;
- layering scheme;
- title blocks;
- data relationships, including subfigures;
- feature control symbols;
- drawing and view structures, including format;
- tolerances.

The selection of Phase II test cases for Class II may specify a particular engineering drawing type as defined in DOD-STD-100, Engineering Drawing Practices.

The appropriate version of this document and MIL-D-28000, to which this test case will be developed, should be identified in a section entitled "Revision and release dates . . ." in the Purpose.

Any deviations taken from the aforementioned documents or criteria should be identified in a section entitled "Deviations" in the Purpose. The only permissible deviations are those requirements which cannot be fulfilled due to the unavailability of proper tools or the presence of conflicting requirements.

A template of the Purpose is provided in Appendix C.

- 4.3. (Phase II only) The customer representatives should provide a hard copy of each graphical representation, including any details, of the data base to be created in the test case to the test case developers. All constraints and desired modifications to the data base should be conveyed on the hard copy or an attachment if they are not already reflected on the hard copy.

## **5. System Selection and Preparation**

- 5.1. The customer representatives should select and provide the CAD system from which the CAD data base, IGES file, and plots should be generated for the test case. The CAD system should be capable of representing the concepts or application scenario under test, in a compliant manner, according to the CAD system documentation.
- 5.2. The IGES experts should specify IGES file analyzer software, to be provided by the customer representatives with supporting hardware, to assist in the evaluation of IGES files. The software should have the capability to pictorially depict data represented in an IGES file and to evaluate the IGES file's compliance to the selected class in MIL-D-28000.

IGES file analyzer software should be evaluated to test their claims of capability to examine IGES files against specifications such as IGES and MIL-D-28000. This document does not provide a methodology to perform this task.

## **6. CAD Data Base Creation and Evaluation**

- 6.1. The test case developers should specify all CAD entity types, as defined by the CAD software, to be applied in data base creation. CAD entity types may have multifaceted applications throughout the data base. For example, a CAD entity type "line" can define part of an engineering drawing format, the structure of a table, and the product itself.
- 6.2. The test case developers should determine the CAD operator commands to create and/or modify CAD entities, selected in Section 6.1, in the context of the entity application. Multiple entities of a single CAD entity type can be created by varied CAD operator commands. For example on a particular CAD system, a CAD entity "arc" in the data base may have been created by the execution of an operator

command "INSERT ARC" while another "arc" entity may have been generated by executing a CAD operator command "INSERT CIRCLE". In this example, both entities of the same type have been generated by different commands.

- 6.3. If an aspect of the test criteria cannot be represented in the CAD data base, due to CAD entities which cannot be reflected as IGES entities compliant to the selected class in MIL-D-28000 and the user-defined requirements according to vendor documentation, the developers should note this in the discrepancy log. This aspect should not be included in the data base at this time.

If a pictorial aspect of the test criteria cannot be represented in the CAD data base by any CAD entities, unless the aspect is color, another CAD system should be selected by the customer representatives, accessed, and configured, according to Section 5, to generate the data base and IGES file. If this is the case, testing should resume with Section 6.1 after this has been accomplished.

If a functional aspect of the test criteria cannot be represented in the CAD data base by any CAD entities, it should be noted in the discrepancy log.

If any aspect cannot be represented due to a perceived error in MIL-D-28000, it should be noted in the discrepancy log. The specification is always honored.<sup>3</sup>

- 6.4. The test case developers should initiate an audit trail to record all user input entered via any input device, automatically if provided by the facilities or manually if not, during data base creation and modification.
- 6.5. The developers also should generate the CAD data base. The concepts or scenario emphasized should be sufficiently exercised for the requirements dictated by the customer representatives according to the Purpose and, for Phase II, accompanying hard copies. Also the data base should correctly reflect the selected application according to MIL-D-28000 and the user-defined requirements. Any aspect which cannot be represented in the CAD data base should be handled according to Section 6.3.

---

<sup>3</sup>Any perceived limitations or errors discovered in MIL-D-28000 shall be reported using DD Form 1426 found on the last page of the specification.

- 6.6. The customer representatives review the CAD data base to ensure that it accurately and comprehensively reflects the concepts or scenario under test according to the Purpose and, for Phase II, the hard copies. The representatives and developers resolve all discrepancies.
- 6.7. An application expert, appointed by the customer representatives, should review the CAD data base to evaluate its interpretation of the selection application, which includes evaluating its compliance to the selected class in MIL-D-28000 and the user-defined requirements. The expert and developers should resolve all discrepancies.

## 7. IGES File Creation

- 7.1. The test case developers should pre-process the CAD data base to create an IGES file. The developers should select the command to accomplish this as to generate an IGES file as compliant to the selected class in MIL-D-28000 and the user-defined requirements as possible according to the documentation of the CAD system.
- 7.2. The IGES experts should manually review the IGES file, excluding the Start section, for compliance to all specified requirements, including IGES. Each non-compliance discovered may be recorded in the discrepancy log as such:
  - name of the section, Global, Directory Entry, Parameter Data, or Terminate, where the error exists;
  - line number the error is on, referencing from the first line in the section where it exists;
  - the parameter where the error occurs if applicable;
  - the reference and the aspect in the reference indicating that this discovery is indeed non-compliant;
  - a proposed, compliant solution.
- 7.3. The test case developers and the IGES experts should compare the resulting IGES file with the CAD data base, applying all specified requirements, to evaluate its interpretation of the data base. Individual reviews should be conducted with a different test case developer and IGES expert participating in each. The IGES expert should interpret the IGES file for the test case developer to compare it to the data base. Each IGES entity and each Global section field should be evaluated against its representation in the CAD data base, in context of the specified requirements and the concepts or scenario to be

stressed by the test case, in the following realms:

- accuracy of the coordinate data in each IGES entity according to the system-specified minimum resolution (Global field 19 in the IGES file) and its mapped CAD entity in the data base;
- accuracy of IGES entity transformations, applying IGES entity 124, compared with their representations in the CAD data base;
- accuracy of the values of such IGES entity attributes such as font, color, weight, and level with their representations in the CAD data base;
- appropriateness of CAD-to-IGES entity mappings depending upon CAD entity functionality and graphical representation.

All discrepancies may be noted in the discrepancy log in the manner outlined in Section 7.2.

- 7.4. The test case developers should modify the IGES file to incorporate the modifications suggested from the analysis outlined in Sections 7.2 and 7.3. Aspects of the concepts or scenario which could not be represented in the CAD data base, as noted during analysis detailed in Section 6.3, are to be incorporated in the IGES file as well. The CAD data base must be modified to reflect all modifications to the IGES file in order to produce a pictorially-correct plot for the test case.
- 7.5. After all modifications to the IGES file from the manual review have been completed, the file should be evaluated for syntactic compliancy to the selected class in MIL-D-28000 by the use of IGES file analysis software. The IGES experts and test case developers should examine and resolve all errors and warnings produced by the software. A tool presenting the graphical representation of an IGES file can be useful in validating the IGES file also. Any modifications made to the IGES file, affecting the graphical representation of the CAD data base, must be incorporated also in the CAD data base.
- 7.6. A hard copy, full-scaled plot should be generated for each graphical representation of the data base. The plots should be produced from the CAD system if it has the capability. Else it should be produced from a capable and accurate IGES file analyzer.

Complementary scaled plots should also be provided. The size of each should be no greater than 11" x 8.5",

landscape orientation. Additional plots illustrating details which may not be pictorially apparent should be generated also.

If possible, a digital representation of the plot may be provided with the test case. The digital format should be indicated in the Purpose.

- 7.7. The test case developers should modify the Start section of the IGES file to depict the information required according to the selected class in MIL-D-28000 and the user-defined requirements. Naturally, the Terminate section should be modified to reflect the size of the Start section if needed.
- 7.8. The IGES file should be saved in an ASCII text file in accordance with reference [7].

## **8. Generation of Data Base Description**

- 8.1. A detailed, system-independent description of each CAD entity in a data base, as reflected in the IGES file, should be generated by the test case developers. The intent of the Data Base Description is to provide a comprehensive specification of the CAD data base to be created for IGES pre-processor testing. Only the information in the corrected IGES file should be reflected, not the CAD data base created to generate this test case. The information should be recorded in an 80-column ASCII text file, or in another format if translatable to ASCII.

The entity descriptions may be recorded in this order:

- structural entities, such as drawings and views; those with a wider scope over the data base should be described before those addressing a smaller scope;
- actual product model including attributes;
- other geometry including attributes;
- annotation for the product model, i.e. dimensions, notes, sectioning.

Appendix C presents example formats for entity descriptions. If the developers and the customer representatives choose not to create the description with readily identifiable parameters and aspects, similar to Appendix C, then a reference should be specified in the Purpose to enable the interpretation of the description. The terminology for describing each CAD entity, including

attributes, should be the terminology describing its mapped IGES entity in the IGES file except if the IGES representation is too difficult to be applied by an experienced CAD operator. If this occurs, then the information should be presented in a suitable manner without sacrificing functionality nor pictorial quality.

The description of each CAD entity reference should include all geometric, structural, and annotative attributes represented in the constructs of the Directory Entry and Parameter Data Sections of the IGES entity in particular and the Global Section as it applies to the entire CAD data base. Such attributes are color, line weight, and transformations.

- 8.2. The Data Base Description, once completed, should be released to the IGES experts for review. The following characteristics of the description should be analyzed for their quality and compliance:

- not written in context of a specific CAD system;
- all aspects of concepts or applications fulfilled;
- all entity attributes, geometric, annotative, and structural, are noted;
- structural entities are properly defined and scoped;
- complete according to Section 8.1;
- comprehensible;
- all aspects are compliant to user-defined requirements and the selected class in MIL-D-28000.

All perceived errors and limitations should be noted in the discrepancy log. These should be resolved between the IGES experts and the test case developers to ensure a correct Data Base Description before proceeding.

If a fault, due to these guidelines, was discovered, it should be conveyed to the custodian of this document as stated in Appendix A.

## 9. Generation of Evaluation Script

- 9.1. The Evaluation Script should be created to assist the CAD/IGES evaluators in determining the post-processor's management of IGES entities. For Phase I test cases, all entities affected by the concepts under examination, either directly or indirectly, should be in the list of entities for evaluation. However, it is too burdensome to require the evaluators of IGES processors to check the accuracy of



each entity in the IGES file provided with a Phase II test case. Therefore, for Phase II test cases, certain IGES entities should be chosen, according to the following guidelines, to represent all aspects reflected:

- each IGES entity type found in the IGES file, including entities with different form numbers;
- any entities which are reflected in several views, drawings, or in other grouping mechanisms, if applicable;
- all curves, surfaces, conics, and other entities requiring complex calculations to verify their mathematical accuracy (for example IGES entities 104, 126, and 128);
- any subfigure definitions and instances;
- all structural entities such as views, planes, and drawings.

9.2. An Evaluation Script created should specify the following characteristics for every IGES entity chosen:

- all coordinate locations, as noted in the PD record, with the significance of each location for that entity;
- several coordinate locations, as many as needed according to the test case developers, to define the curvature and location of such IGES entities as splines and conics;
- all entity attributes, such as font, weight, size, width, height, or color;
- all associativities with other entities if they exist;
- any other information needed to evaluate that entity;
- the aspects under test if it is for Phase I.

The script may be formatted according to an example given in Appendix C. If the developers and the customer representatives choose not to create the script with readily identifiable parameters and aspects, similar to Appendix C, then a reference should be specified in the Purpose to enable the interpretation of the script. The script should be recorded in an 80-column ASCII text file or in a format translatable to 80-column ASCII text. For Phase I test cases, the attributes of the entities which are affected by the concepts under examination should be emphasized. Appendices D and E can be referred to for examples.

## 10. Storage and Delivery of Test Cases

- 10.1. The Purpose, the Data Base Description, and the Evaluation Script of the test case should be stored as 80-column ASCII text files preferably onto a 1.44 MB 3.5" floppy diskette, MS-DOS format. If these cannot be stored in ASCII format, the representation format should be conveyed in the Purpose. The IGES file also should be stored in the same floppy in accordance with reference [7]. The plots and an 8.5" x 11" hard copy of the Purpose should be included.
- 10.2. The test case should be delivered to the CTN. This test case will be abstracted in a future version of reference [6] for testing purposes documented in reference [5].

#### APPENDIX A: REFERENCES

- [1] Digital Representation for Communication of Product Data: IGES Application Subsets and IGES Application Protocols, Military Specification MIL-D-28000, Revision A, Amendment 1, December 14, 1992.
- [2] Digital Representation for Communication of Product Definition Data, ASME Y14.26M, 1989.
- [3] Initial Graphics Exchange Specification (IGES), Version 5.1, Reed, K., Kelly, J., Harrod, D., and Conroy, W., September 1991.
- [4] Initial Graphics Exchange Specification (IGES), Version 5.0, Reed, K., Harrod, D., and Conroy, W., NISTIR 4412, September 1988.
- [5] Test Plan to Evaluate Computer-Aided Design Systems for MIL-D-28000 Compliance With Additional User Requirements, Version 1.0, CALS Test Network, CTN Report 93-016, March 19, 1993.
- [6] MIL-D-28000 Test Case Index and Abstracts, Version 1.0, CALS Test Network, CTN Report 93-018, March 19, 1993.
- [7] Automated Interchange of Technical Information, Military Standard MIL-STD-1840, Revision B, December, 1992.

Copies of references [1] and [7] are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Ave., Philadelphia, PA 19111-5094.

Copies of reference [2] are available from The American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

Copies of reference [3] and [4] are available from the National Computer Graphics Association, 2722 Merrilee Dr., Suite 200, Fairfax, VA 22031, ATTN: IPO Administrator.

Copies of references [5] and [6] are available from the CALS Test Network Office which may be contacted at (513) 257-3085 or lammers@logdis1.hq.afmc.af.mil.

## APPENDIX B: GLOSSARY

class - specifies a particular CAD/CAM application addressed in the realm of product definition data exchange by MIL-D-28000

computer-aided design (CAD) - attributing the function of design to an aspect by means of a computer in which its data generated is digitally stored in a data base accessible to the design software

CAD data base - the CAD system's internal digital representation of user-defined product definition data in a pre-defined structure

CAD entity - an individual element, whose structure is defined by the CAD system, specified by a CAD operator for inclusion in a CAD data base and accessible for modification hereafter

CAD operator command - information issued to the CAD system by the CAD operator in which the intent is to create, modify, or query one or more aspects of a CAD data base

CAD system - software which provides an individual with the capability to design and modify engineering drawings, electrical/electronic products, or other application byproducts, stored in a digital format in a data base

Data Base Description - a document, provided with the test case, comprising of the specification of the contents of the CAD data base to be created for pre-processing into IGES

discrepancy log - a log to record errors and limitations discovered during test case development and validation

Evaluation Script - a script, which is a part of the test case, presenting the aspects to be examined in the CAD data base generated from a post-processed IGES file

functionality - characteristics of a CAD data base which are exclusive of the purely pictorial, graphic realm

graphical representation - how an entity is pictorially depicted to the human eye

Initial Graphics Exchange Specification (IGES) - a specification establishing information structures to be used for the digital representation and communication of product definition data, permitting the compatible exchange of these data used by various

CAD/CAM systems.

IGES file analyzer tools - software which evaluates an IGES file against IGES and/or additional criteria, such as those specified in MIL-D-28000

post-processor - software residing on a CAD system which receives an IGES file and interprets the data in that file, according to its CAD/IGES entity mapping scheme and its internal processing, to generate an equivalent CAD data base

pre-processor - software residing on a CAD system which receives a CAD data base, generated on that system, and creates an IGES file incorporating the data present in the CAD data base depending upon its CAD/IGES entity mapping scheme and its internal processing

product definition data - those data, regardless of form, which determine the essential characteristics of a product in its final or completed state

## APPENDIX C: TEST CASE FORMAT

This Appendix suggests the formats of the test case purpose, Data Base Description, and Evaluation Script of a test case developed according to this document. Each element is generally described in Section 2.2.

**Test Case Purpose.** This identifies the test case for selection by potential testers. This template suggests a format of a test case purpose:

### TEST CASE TEST CASE PURPOSE

Version: \_\_\_\_\_

Date: \_\_\_\_\_

Concept or Application Scenario (circle one)

Criteria: Complies with Class \_\_\_\_\_  
User requirements \_\_\_\_\_  
Concepts or application scenario criteria \_\_\_\_\_

Revisions and release dates of documents to which this test case was developed:

MIL-D-28000: Revision: \_\_\_\_\_, Amendment \_\_\_\_\_  
Date: \_\_\_\_\_

Test Case Development and  
Verification Guide for  
MIL-D-28000, Version \_\_\_\_\_, Date: \_\_\_\_\_,  
CTN Report xx-xxx

Deviations:  
IGES file conforms to \_\_\_\_\_ with an exception to the requirement  
on \_\_\_\_\_

File identification:

README.1ST - this file  
\_\_\_\_\_.IGS - IGES file for post-processing  
\_\_\_\_\_.DBD - specification of \_\_\_\_\_ entities in  
\_\_\_\_\_.DBD - specification of \_\_\_\_\_ drawing format  
\_\_\_\_\_.DBD - specification of \_\_\_\_\_ entities in  
product model

\_\_\_\_\_.DBD - specification of \_\_\_\_\_ entities as  
annotation  
EVALSCR.RPT - specification of criteria for data base  
evaluation

**Data Base Description.** The Data Base Description specifies the contents of the CAD data base to be created and pre-processed. Example formats for various entities are presented.

TEST CASE  
DESCRIPTION - \_\_\_\_\_ VIEW Page \_\_\_\_

ERN \_\_\_\_

Scale  
-----  
\_\_\_\_\_

Matrix equation to transform entities from model space, (X(i),Y(i),Z(i)), into view space, (X(o),Y(o),Z(o)), for presentation in this view:

$$\begin{bmatrix} \text{---} & \text{---} & \text{---} \\ \text{---} & \text{---} & \text{---} \\ \text{---} & \text{---} & \text{---} \end{bmatrix} * \begin{bmatrix} X(i) \\ Y(i) \\ Z(i) \end{bmatrix} + \begin{bmatrix} \text{---} \\ \text{---} \\ \text{---} \end{bmatrix} = \begin{bmatrix} X(o) \\ Y(o) \\ Z(o) \end{bmatrix}$$

Clipping Window in Drawing Coordinates

-----  
from \_\_\_\_\_ to \_\_\_\_\_

Origin of View in Drawing Coordinates

-----

Left Plane

-----

Top Plane

-----

Right Plane  
-----  
-----

Bottom Plane  
-----  
-----

Back Plane  
-----  
-----

Front Plane  
-----  
-----

ERN of Applicable Drawing Entity  
-----  
-----

=====

TEST CASE  
DESCRIPTION - DRAWING FORMAT  
TEXT STRINGS

Page 1

ERN \_\_\_\_\_

Text String  
-----  
-----

Purpose in Drawing Format  
-----  
-----

Text Origin in Top Margin  
-----  
-----

Text Origin in Bottom Margin  
-----  
-----

Text Font	Text Height	String Width	Color	Level
-----	-----	-----	-----	-----
-----	-----	-----	-----	-----



Mirroring   Slant   Rotation   Line Weight  
-----

Dependent ERN Entities and Their Relationship  
-----

ERN of Applicable Drawing Entity  
-----

=====

TEST CASE  
DESCRIPTION - PRODUCT MODEL  
LINES

Page 1

ERN \_\_\_\_\_

Functionality in Product Model  
-----

Start Point  
-----

End Point  
-----

Additional Geometric Requirements  
-----

Line Font   Color   Line Weight   Level   Application  
-----

Dependent ERN Entity and Its Relationship  
-----

=====

TEST CASE  
DESCRIPTION - ANNOTATION  
TEXT STRINGS

Page 1

ERN \_\_\_\_\_

Text String

Purpose in Drawing

Text Origin

Text Font	Text Height	String Width	Color	Level
-----------	-------------	--------------	-------	-------

Mirroring	Slant	Rotation	Line Weight
-----------	-------	----------	-------------

Dependent ERN Entity and Its Relationship

**Evaluation Script.** This is a sample format of a particular entity type for the abstract script to which the CAD data base will be evaluated. The format depends upon the entity type. The "Concepts Specification" section should only pertain to Phase I test cases.

**"PYRAMID" TEST CASE  
EVALUATION - PRODUCE MODEL  
LINES**

Page \_\_\_\_

ERN \_\_\_\_

**Functionality in Product Model**

---

Start Point

End Point

**Additional Geometric Requirements**

---

Line Font	Color	Line Weight	Level	Application
-----------	-------	-------------	-------	-------------

---

**Concepts Specifications (PHASE I TEST CASES ONLY)**

---